AD-A052 228 ARINC RESEARCH CORP SANTA ANA CALIF F/G 1/3
ENGINEERING SUPPORT TO NMC IN DEVELOPMENT OF MANAGEMENT SYSTEMS--ETC(U)
JUN 74 H A LINDGREN F09603-73-A-4392
UNCLASSIFIED W4-1055-TN01 NL

1 OF 1
AD
A052228

END
DATE
FILMED
5-78
DDC

4

TECHNICAL NOTE

ENGINEERING SUPPORT TO NMC IN DEVELOPMENT OF MANAGEMENT SYSTEMS FOR AERIAL TARGETS

Volume I: Development of Functional Block Diagram for Aerial Target Status Summary Model

June 1974

Prepared for

U.S. NAVAL MISSILE CENTER
Pt. Mugu, Calif.

Under Contract F09603-73-A-4392
Task Order 0005

Publication W4-1055-TN01

Special Projects Branch
ARINC RESEARCH CORPORATION
P.O. Box 1375/Santa Ana, Calif.

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE *(When Data Entered)*

14 REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER W4-1Ø55-TNØ1	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
6 4. TITLE (and Subtitle) ENGINEERING SUPPORT TO NMC IN DEVELOPMENT OF MANAGEMENT SYSTEMS FOR AERIAL TARGETS. Volume I. **Development of Functional Block Diagram for Aerial Target Status Summary Model.**		9 5. TYPE OF REPORT & PERIOD COVERED Technical note, 6. PERFORMING ORG. REPORT NUMBER W4-1055-TN01
7. AUTHOR(s) 10 H.A. Lindgren		8. CONTRACT OR GRANT NUMBER(s) 15 FØ96Ø3-73-A-4392
9. PERFORMING ORGANIZATION NAME AND ADDRESS ARINC Research Corp. P.O. Box 1375 Santa Ana, California 92702		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS U.S. NAVAL MISSILE CENTER Pt. Mugu, Calif.		11 12. REPORT DATE Jun[redacted]74 13. NUMBER OF PAGES 29 12 30 p.
14. MONITORING AGENCY NAME & ADDRESS *(if different from Controlling Office)* U.S. NAVAL MISSILE CENTER Pt. Mugu, Calif.		15. SECURITY CLASS. *(of this report)* UNCLASSIFIED 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT *(of this Report)*

UNCLASSIFIED

17. DISTRIBUTION STATEMENT *(of the abstract entered in Block 20, if different from Report)*

18. SUPPLEMENTARY NOTES

19. KEY WORDS *(Continue on reverse side if necessary and identify by block number)*

20. ABSTRACT *(Continue on reverse side if necessary and identify by block number)*

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE *(When Data Entered)*

400 711

4

ENGINEERING SUPPORT TO NMC IN DEVELOPMENT OF MANAGEMENT SYSTEMS FOR AERIAL TARGETS

Volume I: Development of Functional Block Diagram for Aerial Target Status Summary Model

June 1974

Prepared for

U.S. NAVAL MISSILE CENTER
Pt. Mugu, Calif.

Under Contract F09603-73-A-4392
Task Order 0005

Prepared by

H.A. Lindgren

Approved by

R.G. Hemann

ARINC RESEARCH CORPORATION
Special Projects Branch
P.O. Box 1375
Santa Ana, California 92702

Publication W4-1055-TN01

FOREWORD

This report describes support services provided by ARINC Research Corporation to the U.S. Naval Missile Center, Pt. Mugu, Calif., relating to the Engineering Management Information System being developed by NAVMISCEN for aerial target systems. Results of specific tasks conducted by ARINC Research are discussed in two volumes:

- Volume I – Development of Functional Block Diagram for Aerial Target Status Summary Model
- Volume II – Cost Effectiveness of Aerial Target Accident/Incident Investigations

Each volume describes the approach taken in the particular study discussed, presents results and conclusions, and offers recommendations where appropriate.

CONTENTS

ILLUSTRATIONS AND TABLES

1
INTRODUCTION AND SUMMARY

In accordance with Subtask I of Contract F09603-73-A-4392, issued by the Naval Missile Center/Pt. Mugu, ARINC Research Corporation conducted the necessary research and analysis to formulate a generic functional flow block diagram representing an Aerial Target Status Summary Model (ATSSM).

Section 2 of this report describes the approach taken in certain activities prerequisite to model development – defining the objectives, attributes, variables, and constraints of a logistic pipeline for a family of recoverable type aerial targets.

Section 3 discusses the development of the ATSSM, and provides a functional flow block diagram of the model. For each segment (block) of the model, all functional relationships and all data requirements are identified. Also included in this section is a comparison of the functional ATSSM with the NAVMISCEN Air Launched Weapon System Status Model (ALWSS).

Section 4 discusses the sources and availability of the data as inputs to the ATSSM, and suggests a series of steps that might be appropriate for follow-on-effort to develop the mathematical relationships of the functional flow diagram representing the ATSSM. Additional information is provided to assist in an implementation program.

2 PREREQUISITE ACTIVITIES

2.1 SELECTION OF REPRESENTATIVE TARGET FAMILY

As an initial effort in developing the ATSSM, ARINC Research evaluated the array of aerial targets under the cognizance of NAVMISCEN to identify a family type possessing the widest range of operational characteristics and logistic support requirements. Another important criterion was that the targets have been in the inventory long enough that the data necessary for the study were readily available.

The recoverable type of target was chosen as the representative family for this study, since that type satisfies the above criteria. Specifically, the recoverable target:

a. Incorporates a turnaround maintenance concept, whereas expendable targets do not

b. Has expendable equipment, such as parachutes and squibs, which must be replenished between flights

c. Can be configured with one or more kits to simulate a wide range of different targets

d. Has been in the inventory for an extended period

e. Is planned for continued use in the foreseeable future

f. Has adequate, readily available data sources.

From an operations standpoint, a target can be just as unavailable to a user for lack of expendables and kits as it can be for spare parts. Therefore the recoverable target family appears to offer all of the possible dimensions for pipeline modeling that would be representative of targets in general.

2.2 SCOPE OF AERIAL TARGET SURVEY

Following the selection of recoverable targets as the representative family, an evaluation of their characteristics pertinent to this study was undertaken. Determination of the system configuration and logistic support requirements for each target type

is a prerequisite to modeling of the logistic pipeline. Within the recoverable target family, each configuration variation was identified and the associated augmentation kits and launch and recover alternatives were examined. Figure 1 shows the format used to document the data, and includes example entries significant to model development.

2.3 PIPELINE ANALYSIS

In this section, the logistic pipeline is examined in terms of the parameters significant to the management of target resources.

To analyze the pipeline process, the flow diagram of Figure 2 was developed. This diagram depicts, from left to right, the transitions by which budget resources are converted to usable target equipments. Although the diagram is based on recoverable-type targets, it has application to all models of targets with the exception of some aspects of converted manned aircraft. Shown along with the target pipeline flow are the corresponding sequences for spares, kits, and expendables.

In Figure 2, only certain of the transitions correspond to changes in configuration of target resources. The ATSSM must incorporate these changes to be useful in resource allocation and system effectiveness monitoring. Table 1 is a matrix of these state changes versus the affected category of resources, i.e., targets, kits, spares, and expendables. Note that state changes for these resources do not correspond at every step of the pipeline sequence.

Table 2 lists the key questions to be answered by decisionmakers concerned with providing target services. The ability to answer these questions is the basic objective of an Aerial Target Status Summary Model. The questions are divided into three categories:

a. Allocation questions, which include consideration of the various user requirements and the budgeting of dollar resources into material equipment types and quantities for input to the pipeline, with allowance for lead times and quantities appropriate for projected consumption rates.

b. Availability questions, which concern logistic and maintenance considerations that, when satisfied, will provide operable targets to meet a projected demand.

c. Mission reliability questions, which relate to the loss of targets due to inflight malfunctions.

Category	Designation*	Power Plant	Guidance	Performance			Signature			Launch and Recovery Options*	Kits			Augmented Performance
				Speed (knots)	Altitude (feet)	Endurance on Station (minutes)	Visual	IR	RCS		ECM*	Scoring	Augmentation*	
Powered Recoverable Targets →	BQM-34A	CAE J69-T29	Radio Command	600	60,000	86				Air or ground launch, surface recovery with chutes	AN/DLQ-1, -2, and -3 CM sets	AN/USQ-11 and Photon MDI	Radar beacons C-, X-, and L-band	
											Rocket and chaff dispenser	FEI camera pods	IWT's S-, C-, X-, and L-band	
													IR flares	
													Smoke equipment	
													Tow target	
	BQM-34AS												Same as above	
	MQM-74A													
	MQM-74AS													
	BQM-34E													
	BQM-34ES													
	(Etc.)													
Powered Non-Recoverable Targets →														
Towed Targets →														

*These columns have significance relative to the Aerial Target Status Summary Model.

Figure 1. Format, Aerial Target Performance Data Summary

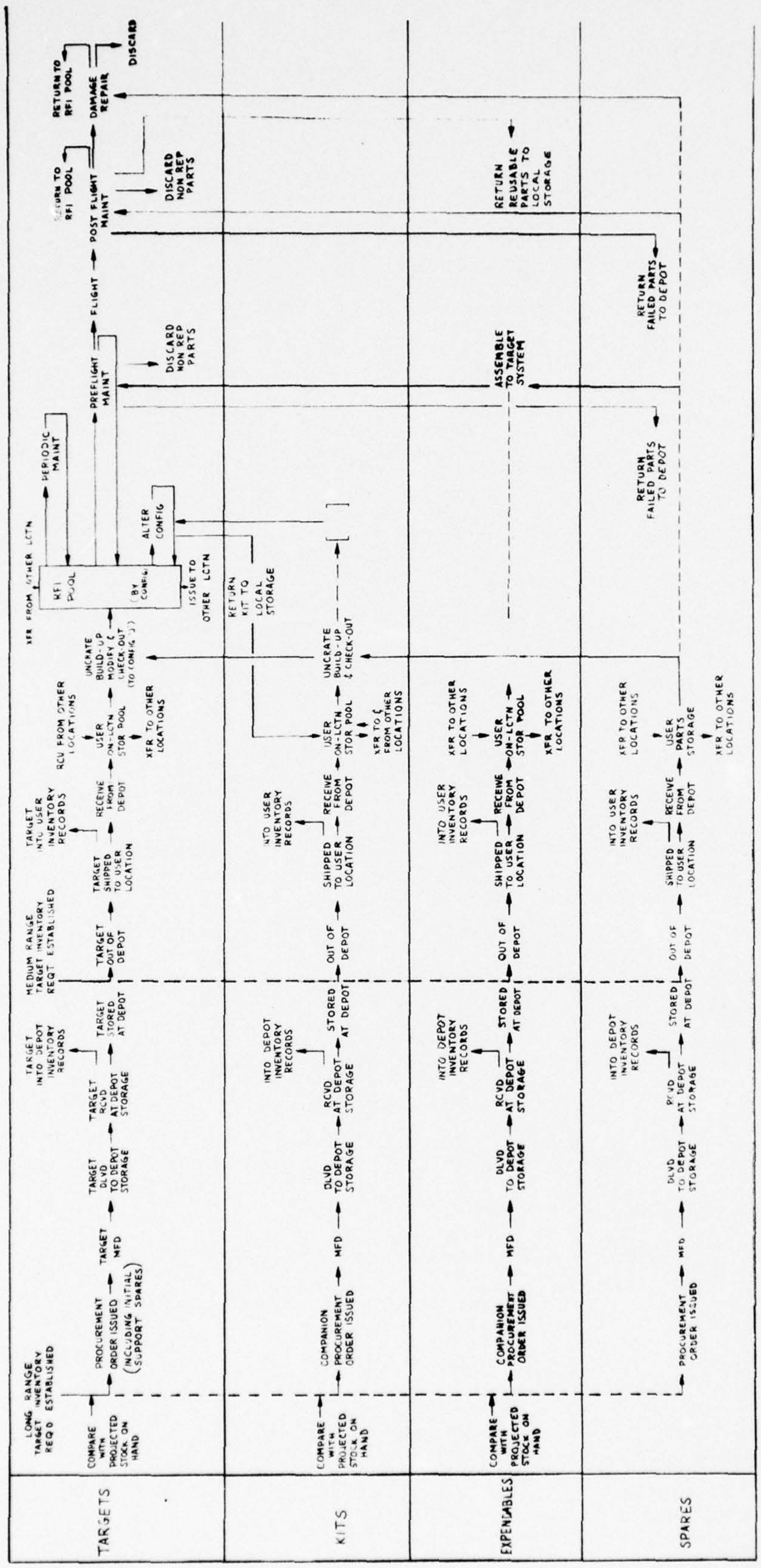


Figure 2. Target Pipeline Flow

TABLE 1. MATRIX REPRESENTATION OF PIPELINE ATTRIBUTES AND VARIABLES FOR AERIAL TARGETS

Pipeline Attributes and Resources Involved in State Change	Configuration Element Involved in Change				Variables and Constraints Significant to Change
	Targets	Spares	Kits	Expendables	
Target spares, expendables allocation established	X	X	X	X	Number per month committed (for each configuration)
Procurement order	X	X	X	X	Date of new orders
Manufacture/repair	X	X	X	X	Lead time (for each configuration)
Delivery to ASO	X	X	X	X	Rate of delivery (per configuration) to storage; mean repair time (by basic category); number in stock at any time
Transfer to user	X	X	X	X	
Buildup and checkout	X	X			Buildup delay time; reject rate by part type
Modification			X		Modification downtime (by modification type)
1st RFI TRANSITION					
Modification	X		X		Modification downtime (by modification type)
Periodic maintenance		X			Downtime (avg.) for periodic maintenance
Preflight		X		X	Reject rate by part type; number of service channels
Flight	X		X		Inflight failure rate (by major assembly)
Postflight maintenance		X			Removal rate by part type
Repair of damage	X	X			Mean downtime for repair; number of service channels (special for decontamination)
Discard	X	X			Average rate of nonrepairable damage (including water damage)

TABLE 2. KEY QUESTIONS AND REQUIRED ANSWERS FOR PROVIDING TARGET SERVICES (Sheet 1 of 2)

Questioned Item	Required Answer	Rank Order*
A. ALLOCATION		
Target allocation	Present base loading.	1
	Expenditure rate profile.	1
	Projected uncommitted RFI margin.	1
Reallocation adjustment	Projected uncommitted RFI targets.	1
Reorder alert	Projected uncommitted RFI targets.	1
Reaction to 1) utilization plan changes, 2) proposed allocation cuts/diversions, and 3) mod programs.	Projection of RFI impact.	2
Allocation for required availability	Number of extra targets to achieve given availability.**	3
	Present base loading.	1
	Expenditure rate profile.	1
	Projected uncommitted RFI margin.	1
B. AVAILABILITY		
Expendables adequacy	Present spares depth. Projected spares margin.	1
Spares adequacy	Present spares depth. Projected spares margin.	1†
RFI level required for 1) reaction to peak loads, and 2) achieving average availability goal	Probability of capability to satisfy X out of Y presentations over an arbitrary period.	1): 4 2): 3
Overall spares level for adequate availability	Probability of not supporting presentation demand due to spares unavailability.	3
Allocation of resources for spares to maximize system availability	Failure rates for replaceable assemblies and parts.	4
	Level of repair.	4

*1 — Least detailed inputs, 2 — Next most detailed inputs, 3 — etc., 4 — etc.
**Availability includes such detailed data as equipment downtime.
†Although the depth of detail is comparable to that of expendables, the quantity of data is perhaps an order of magnitude greater.

TABLE 2. (Sheet 2 of 2)

Questioned Item	Required Answer	Rank Order*
B. (Continued)		
Optimum base manning	Projected target flight requirements including peak load and multiple flight details.	4
	Skills requirements.	4
C. RELIABILITY		
Trends in malfunction pattern	In-flight failures by target type and failing item.	3
Variations in malfunction by location	In-flight failures by target type, location and failing item.	3
*1 — Least detailed inputs, 2 — Next to most detailed inputs, 3 — etc., 4 — etc.		

The allocation and availability questions have a basic parameter in common: the loss rate for targets due to unreliability. Availability and mission reliability questions concern the detection of trends that could lead to improvements in equipment, procedures, and data, yielding increased utilization of given resources.

The level of detail to be treated in a model is of primary importance. Accordingly, the questions in Table 2 are ranked in order of the detail required of input data for meaningful model outputs — the higher the ranking number (1 to 4), the greater the detail of the required data.

2.4 ALLOCATION AND AVAILABILITY FACTORS CONSIDERED IN MODEL DEVELOPMENT

Regarding model outputs, a distinction must be made between the outputs required for allocation and the assessment of availability. For allocation, the important factor is the number of targets serviceable, either in crates or assembled at an operating base. Ideally this tally should include an accounting for kits so that a

capability against various requirements can be stated, e.g., X targets of configuration A, Y targets of configuration B, etc. For flight-line availability, only targets that are assembled and checked out are of interest. An accurate model of availability must show targets that are down for any reason, including lack of parts. Other parameters, including repair time, number of service channels, and system failure rate, must also be accounted for in the model.

If the demand for target presentations remains essentially unchanged from one period of time to the next, a pointwise or average availability model can be meaningful. However, with a widely varying demand, the average availability output can be quite misleading in that peak demands may in fact be poorly serviced due to queueing, whereas the model may indicate acceptable availability. A difficult factor to contend with in availability analysis is the ingenuity of the local service organization in anticipating and meeting peak demands, i.e., minimizing downtime through actions such as the "hangar queen" practice and early withdrawal from depot storage as a hedge against parts outage.

3
MODEL DEVELOPMENT

This section describes the formulation of an Aerial Target Status Summary Model based upon the logistic pipeline analysis of the previous section.

3.1 MODEL FUNCTIONAL FLOW DIAGRAMS

Figure 3 depicts the basic block diagram for the ATSSM. The flow indicated by the arrows in this diagram corresponds to the sequence in which the model operations would be performed. Each block is cross-referenced to more detailed functional relationship diagrams that follow.

The concept applied in constructing the model involves a month-by-month comparison of a projected demand for target services and a projection of available targets. The data base can either be projected forward from the past period or updated with actual operational data.

The overall model when constructed and implemented, need be exercised only as required. However, updating of the data base (as shown in block 1) is indicated as a monthly function, simply because most of the input data will have been quantized into monthly cells.

3.1.1 Block 1 — Update Data Base

The data base maintained through the process of block 1 of the flow diagram comprises four basic elements: stock on hand, mission reliability, mission survivability, and deliveries. Figure 4 illustrates the detailed treatment of "stock on hand" (sub-block 1A). Listed in the figure are the kinds of data required to compute this parameter. These data represent the actual changes occurring in a previous month, covering losses, discarded assets, numbers of flights, and deliveries. All of these inputs are used to update last known data, which are contained in arrays as indicated on the right-hand portion of the figure.

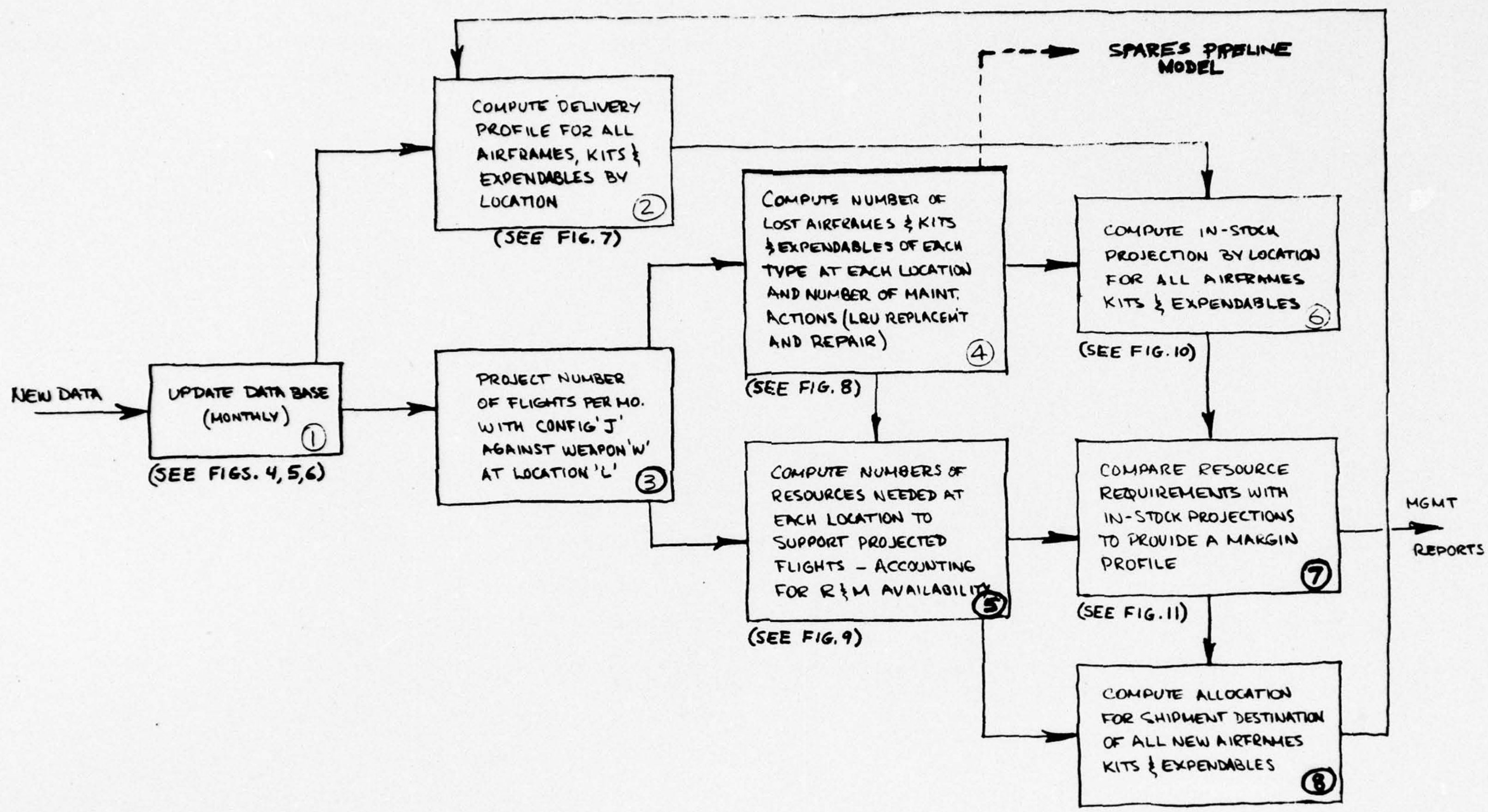


Figure 3. Basic Flow Diagram for Aerial Target Status Summary Model

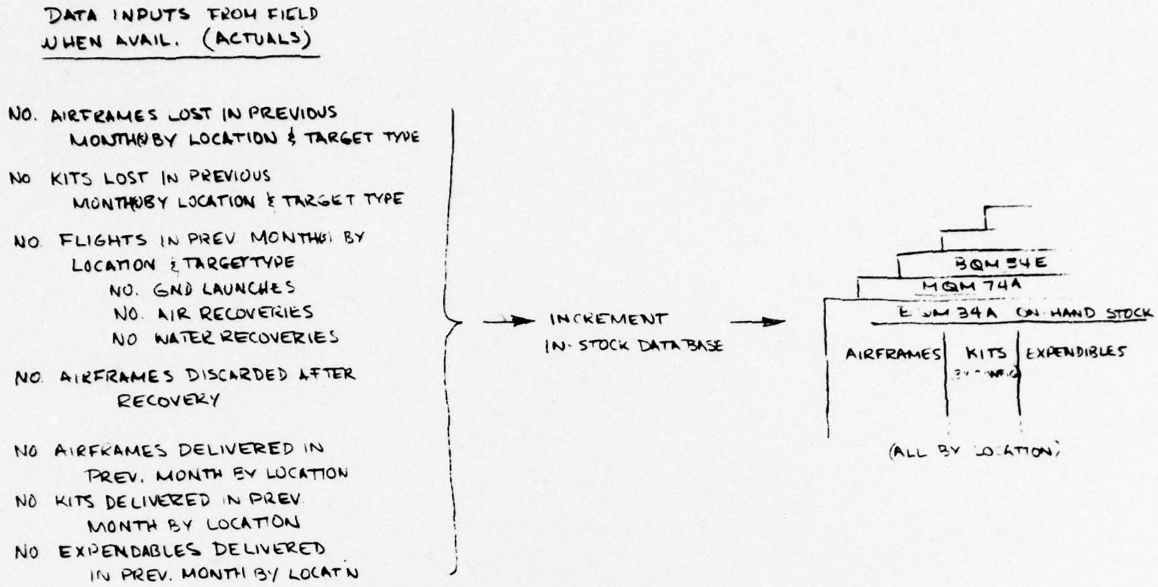


Figure 4. Data Maintenance, Stock on Hand (Sub-Block 1A)

There is a stock-on-hand array for each target type, covering airframes, kits, and expendables by location. "Location" refers to each of the ASO stocking points and all of the operating locations drawing from these points. No distinction between the actual location of these assets is necessary for the initial objectives of the model. At some later period, if desired, the arrays can be expanded to include a location code, as well as a status code, the latter to indicate whether the article is in a crate, assembled and checked out, or down for maintenance.

Mission survivability (sub-block 1B, Figure 5) represents the probability of kill, which is derived from past experience. The array on the right-hand side of Figure 5 indicates the form of survivability data used by the model after is is processed. This array contains a probability number at the intersection corresponding to a given target configuration being fired upon by a specific missile launched under a given set of operational conditions. This array is constructed from a calculation based upon the types of historical data indicated on the left side of the figure. Probability of survival is equal to the number of times a target was not destroyed divided by the number of times the target was fired upon.

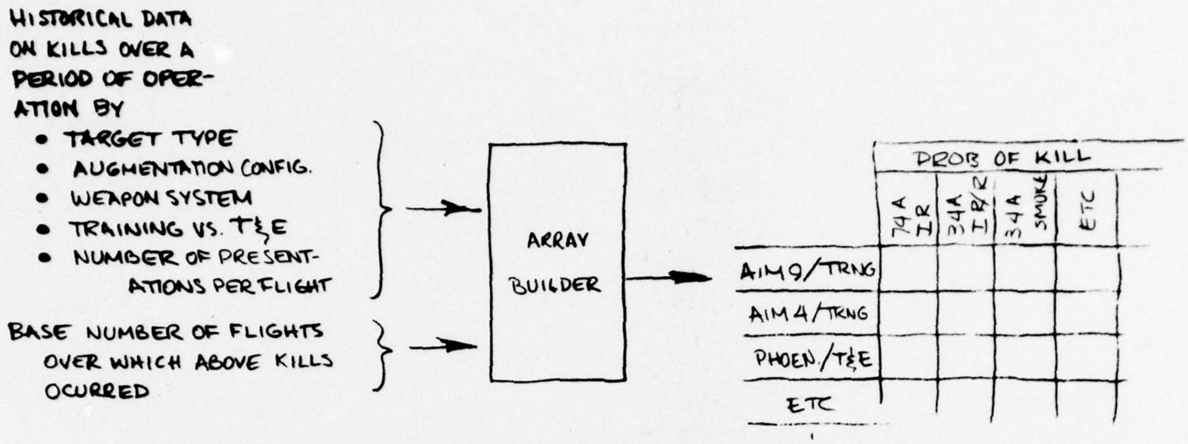


Figure 5. Data Maintenance, Mission Survival (Sub-Block 1B)

Figure 6 illustrates the treatment of data relating to mission reliability (sub-block 1C). In this case there are four separate arrays to be maintained, corresponding to the types of data required. These data types include the number of losses, the number of missions not accomplished, the number of line-replaceable units failed, and the number of airframes that sustained failures to an extent requiring removal of the airframe from the flight line. Probability numbers are generated from historical data corresponding not only to the aerial target type, but also to the primary operational conditions that impact upon reliability, such as method of launch, method of recovery, and the squadron performing the operation.

3.1.2 Block 2 – Compute Delivery Profile

In block 2, the schedules are obtained from the contract DD-1423's. The model design (Figure 7) requires that deliveries be specified by geographic location, which may not be known until just prior to actual shipment. However, an arbitrary allocation to the different stocking points can be made since the output of the model will determine the ultimate shipping allocation. This reallocation process is indicated by the arrow from block 8 to block 2. The output of block 2 is a set of delivery schedules for each location, depicting projected monthly deliveries of airframes, kits, and expendables for each target type.

3.1.3 Block 3 – Project Monthly Flights

Block 3 of the functional flow diagram represents the statement of user requirements. Requirements will be in terms of flights per month sorted according to basic

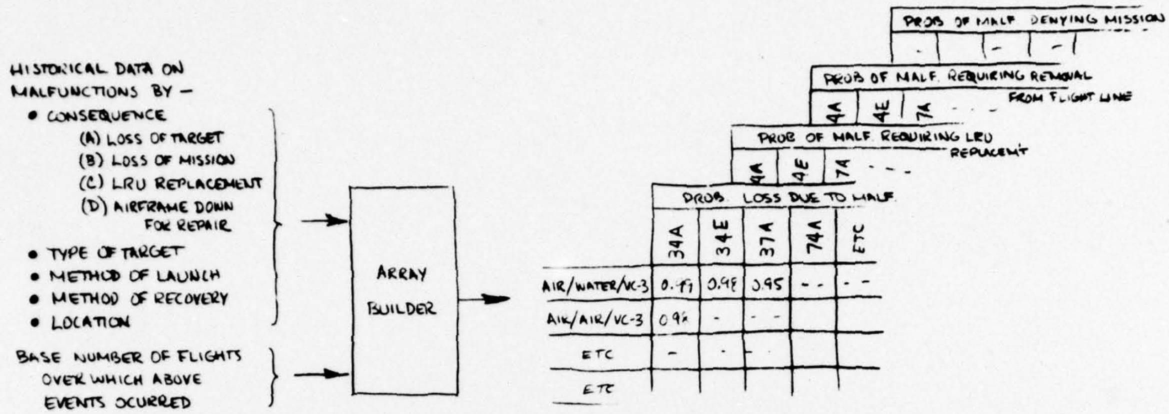


Figure 6. Data Maintenance, Mission Reliability (Sub-Block 1C)

Figure 7. Delivery Projections (Block 2)

location – for example, ASO (North Island)/VC-3. Ultimately, each statement will categorize a flight according to target type and configuration, as well as the weapon to be fired against the target. The latter will be required to permit determination of the kill probability in the succeeding step of the model.

3.1.4 Block 4 – Compute Resource Changes

The model process represented in block 4 and detailed in Figure 8 utilizes the projected flight requirements from block 3 to select, from the survivability and reliability probabilities arrayed within the data base, the expected values of:

a. Probability of kill

b. Probability of loss due to malfunction

c. Other changes in target state accruing from flight.

The selected kill probability from the arrays, when multipled by the number of flights under conditions corresponding to those of the array cell, yields the expected number of events per month (e.g., the number of airframes lost to weapon kills). The rate at which expendables are consumed is derived from the flight projections by operating on the projected rates with the knowledge of launch and recovery methods. For example, if eight flights requiring MARS recovery are projected at a given location during a particular month, there will be eight sets of MARS recovery equipment consumed in that same month.

The reliability events or outputs from this process will be utilized in more than one succeeding block of the model. The number of target resources lost due to catastrophic failures will be utilized in block 6 along with the number of target resources lost to kills. The number of missions denied due to malfunction, and the number of airframes down for repair, will be used in block 5 to support a realistic availability assessment.

3.1.5 Block 5 – Determine Target Requirements

In block 5 the basic process involves converting the projected number of flights per month (from block 3) into the required number of airframes, kits, and expendables needed at the beginning of each month. Figure 9 illustrates this process. In this figure, the first operation accounts for the possible repeat of a flight when a planned flight results in an abort or denial of the successful presentation. Some users may

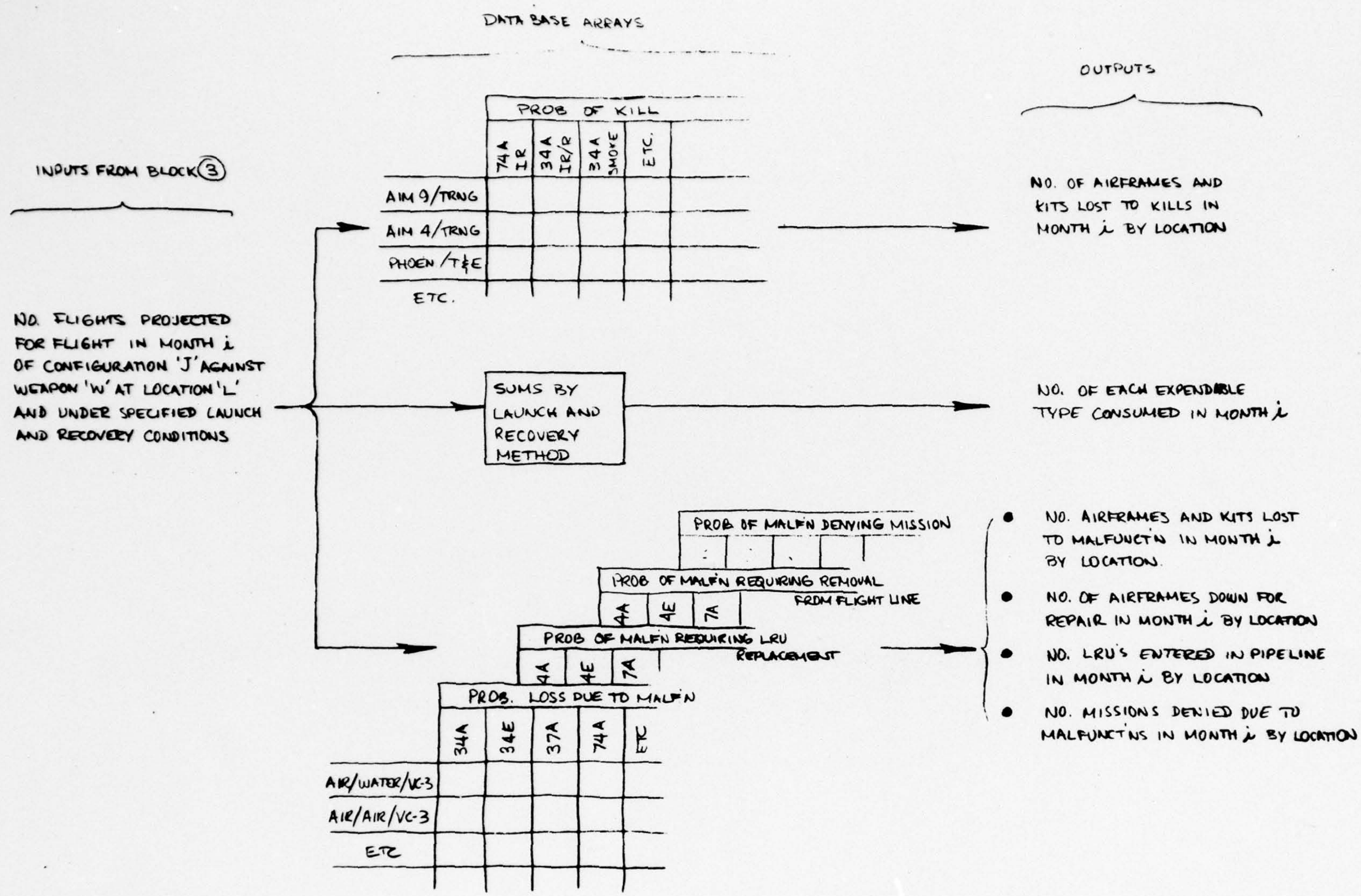


Figure 8. Resource State Changes Through Flight (Block 4)

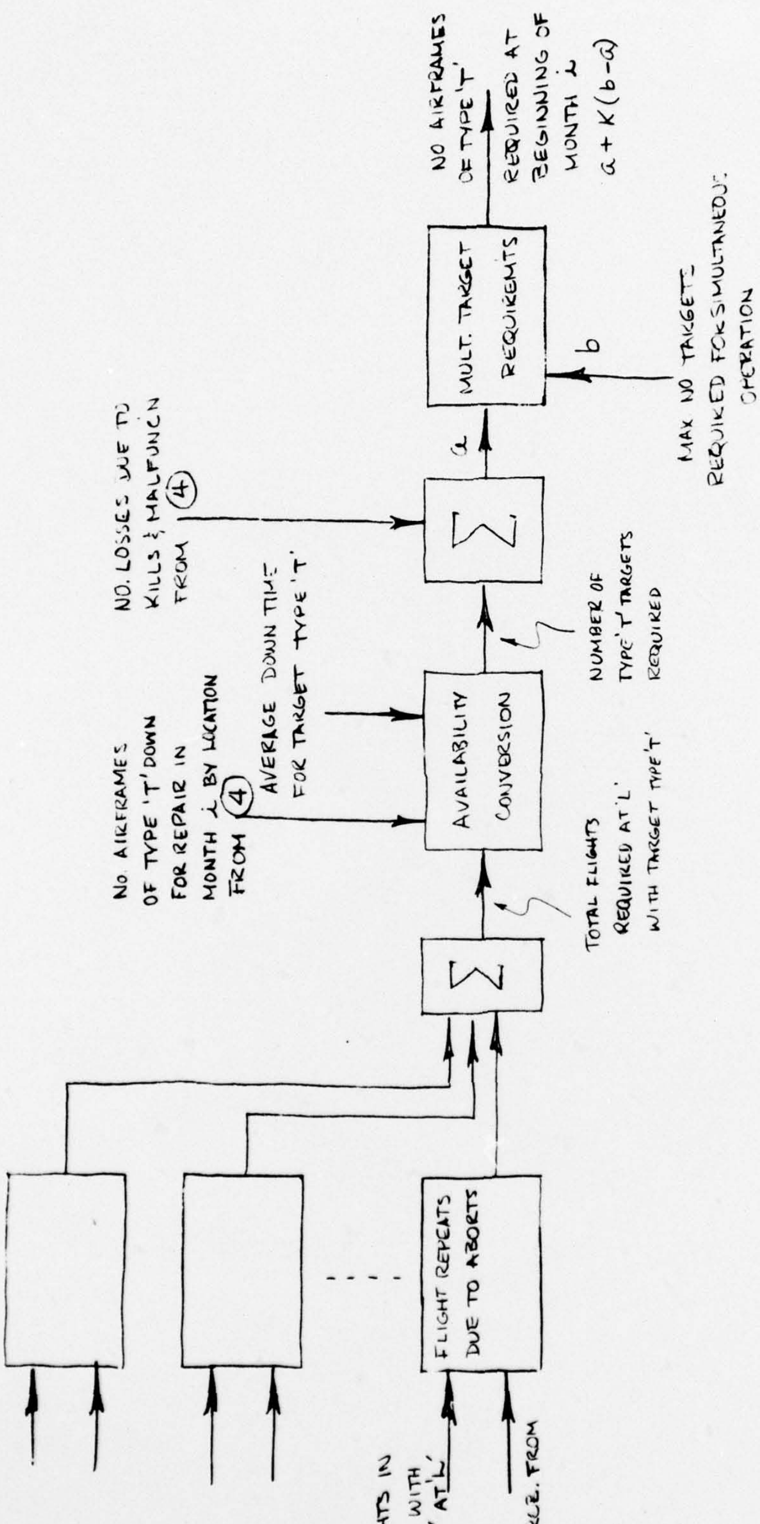


Figure 9. Type 'T' Target Requirements at Location 'L' (Block 5)

not require a repeat flight. To account for all cases, a factor between 0 and 1 can be utilized to represent the likelihood of a repeat-flight requirement.

The next process shown in Figure 9, "Availability Conversion", converts data from flight rate to number of targets required. The input required for this conversion is the downtime for the particular target type. Initially, an average downtime including turnaround will be sufficient. At a later time it may be desirable to obtain from historical records a distribution of downtimes accounting for decontamination and airframe repair, in addition to normal turnaround maintenance. To illustrate the conversion, if the extreme is represented by a total flight requirement of 10 flights in a 30-day period, and if the downtime is 0 to 3 days, then only one target is needed to satisfy that requirement. However if the average down time exceeds three days, then more than one target will be required.

Following the availability conversion process, an increment of targets is added to the total required to account for the losses expected.

Up to this point it is assumed that the user required only one target per flight operation. To account for simultaneous target requirements, the last process in Figure 9, "Multiple Target Requirements", factors in an increase in the number of targets required to correspond to the magnitude of the simultaneous target requirement. If, for example, a number of targets are required at the beginning of a month to satisfy all flight requirements without regard for simultaneous operations, and if one of these operations involves the use of three targets flying simultaneously, then the total number of targets required at the beginning of the month must be increased by up to three additional targets. The increase need not match the number of targets in the simultaneous requirement, since the operating squadron may find it has more than enough on hand due to statistical fluctuations around the model projections. The constant K in the expression shown in Figure 9 accounts for an adjustment of this increment based upon further analysis.

3.1.6 Block 6 – Compute Projected Resources

The computation of projected resources in stock (block 6, Figure 3) is a fairly simple calculation and is shown in Figure 10. The basic calculation starts with the number of resources currently on hand, taken from the data base shown in Figure 4; and simply adds the cumulative sum of all deliveries up to the month in question and

subtracts the cumulative losses of resources up to that same month. The result is the number of resources (airframes, kits, and expendables) projected to be on hand, by location, at the end of that month.

3.1.7 Block 7 – Compute Margin Profile

The process represented in block 7 of the model flow diagram is one of comparing, on a month-by-month basis, the projected in-stock resources with the projected resource needs. The latter values are calculated as indicated in blocks 6 and 5, respectively. This block 7 calculation is illustrated in Figure 11. A typical printout format is depicted, showing both the in-stock projection and the required resources against a time axis such that the margin is readily apparent.

As shown in the illustration, there is a point in time where the two curves cross, which means the difference or the margin becomes negative. This would represent a month wherein the resources on hand at a location might not support flight requirements. Two management actions can be initiated based upon this crossover point. One is to examine the margin corresponding to other locations for the same target or resource type to determine if a change between locations will alleviate the problem. If this first action is not desirable, a trial adjustment to the delivery schedule of block 2 can be attempted and the model rerun to show the effect this action will have on the crossover point of the margin.

3.1.8 Block 8 – Compute Destination Locations

Alteration of allocation of shipments between stocking locations could present a problem. Block 8 of the model diagram illustrates a process wherein adjustment of delivery orders can be made to cause resources in procurement to be assigned to ultimate stocking points in the best possible allocation. The optimum time and quantity to order can be determined by successive reiterations of the model.

3.1.9 Indicated Refinements

The model described in the preceding paragraphs contains some areas where refinement will be desired in the future. This is particularly true in the areas of availability and inventory control. As now structured, the model will provide adequate management support of questions down to and including the level 2 detail indicated in Table 2. Limited support of level 3 detail questions will be provided. However, this will depend somewhat upon the construction of the final algorithms, and upon the quality of the data concerning vehicle downtime.

$$\left(\text{NO. AIRFRAMES, KITS \& EXPENDABLES ON HAND BY LOCATION AT END OF } i^{TH} \text{ MONTH (BEGINNING OF } (i+1)^{TH} \text{ MONTH)}\right) = \left(\text{NO. AIRFRAMES, KITS AND EXPENDABLES CURRENTLY ON HAND BY LOCATION (FROM 1A)}\right) + \sum_{i} \left(\text{NO. AIRFRAMES, KITS AND EXPENDABLES SCHED. FOR DELIVERY IN } i^{TH} \text{ MONTH BY LOCATION (FROM 2)} - \text{PROJECTED LOSSES OF AIRFRAMES, KITS AND EXPENDABLES BY LOCATION IN MONTH } i\right)$$

Figure 10. In-Stock Projection (Block 6)

$$\left(\text{PROJECTED IN-STOCK AIRFRAMES, KITS \& EXPENDABLES BY LOCATION AT END OF MONTH } i \text{ (FROM 6)}\right) - \left(\text{AIRFRAMES, KITS \& EXPENDABLES REQUIREMENTS BY LOCATION FOR MONTH } i+1 \text{ (FROM 5)}\right) =$$

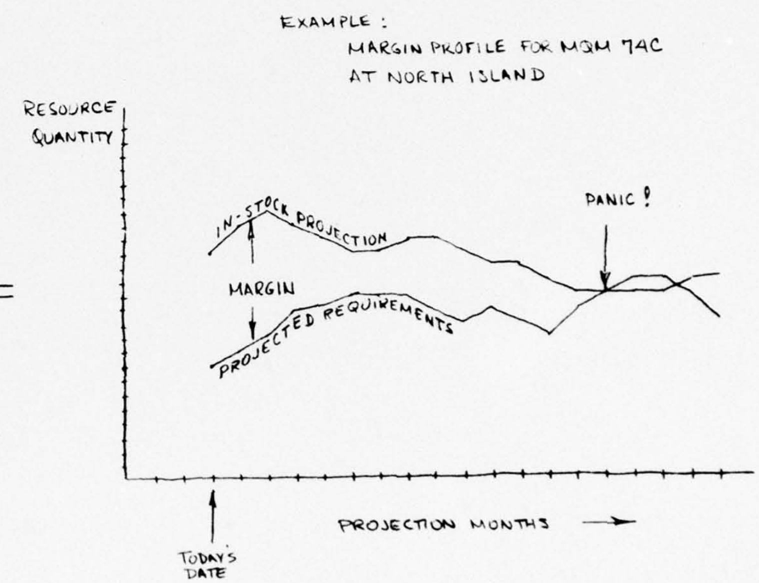


Figure 11. Resource Margin Profile (Block 7)

3.2 COMPARISON WITH ALWSS MODEL

The capabilities of the Aerial Target Status Summary Model overlap those of the Air Launched Weapon System Status (ALWSS) model to the extent indicated in Figure 12, and as discussed in this section.

Figure 12 is an equivalent pipeline diagram of the ALWSS model, onto which the capabilities of the ATSSM are superimposed by shading and dashed lines.

3.2.1 ALWSS Advantages

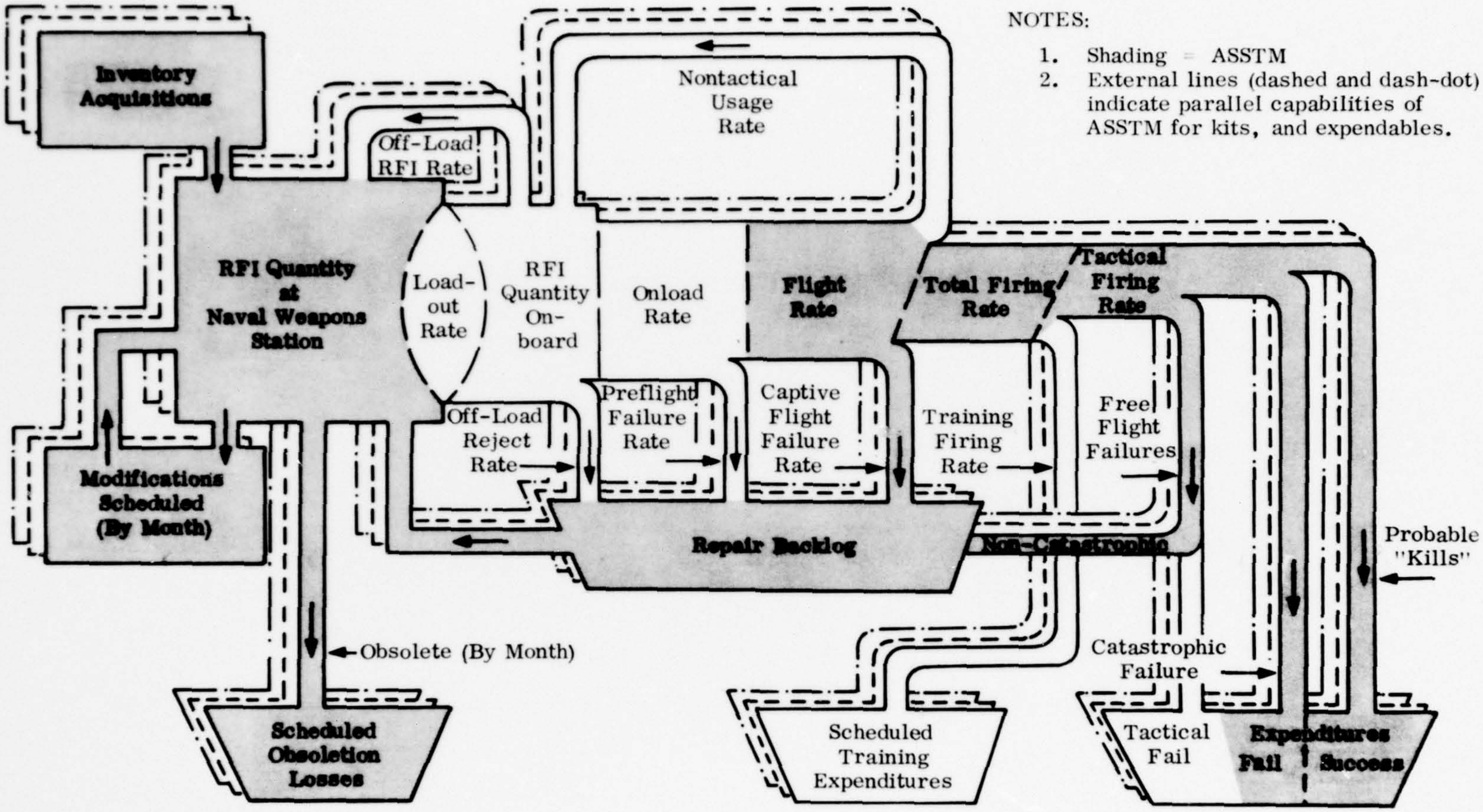
The most notable areas not covered by the ATSSM is in the transitions between the local Aviation Supply Office stocking point and the various possible user storage points such as hangars and ships. Although these transitions are significant they were left to a latter phase of ATSSM growth, partly because the tracking of transitions requires more data from field locations than are currently available.

Scheduled training expenditures and nontactical usage do not appear to have a counterpart in target operation, and were therefore not included in the ATSSM formulation. Note also that the ALWSS path labeled "Free Flight Failures" leading to expenditure, is redefined in the ATSSM as "noncatastrophic free flight failures" and leads instead to the repair pool.

3.2.2 ATSSM Advantages

Several aspects of ATSSM are not treated by ALWSS. Most important of these is the inclusion in the ATSSM of kits and expendables, in addition to the target vehicle itself. A pictorial representation of this would be parallel diagrams, identical to Figure 12, for these items.

One additional feature of ATSSM worthy of mention is the accounting by basic location for all resources even when they exist only as a delivery schedule. This feature will be especially useful in the management process of allocation of target resources.



NOTES:

1. Shading = ASSTM
2. External lines (dashed and dash-dot) indicate parallel capabilities of ASSTM for kits, and expendables.

Figure 12. Comparison of ASSTM and ALWSS Capabilities

4
DATA REQUIREMENTS AND MODEL UTILIZATION

For proper implementation of the Aerial Target Status Summary Model described in this report, the requirements for and availability of data must be carefully assessed. In addition, procedures for timely utilization of the model must be developed so that its maximum potential as an aid to resource management can be realized. The following sections address these topics.

4.1 DATA REQUIREMENTS AND AVAILABILITY

In connection with this investigation, several sources of data were reviewed. These include:

a. The raw data generated at two aerial-target operating locations, North Island and Pt. Mugu.

b. AWCAP reports and MAFs at Pt. Mugu.

c. The 12 data sorts developed by NAVMISCEN Code 5700 based upon the 3M tapes.

The data generation process was judged to be adequate, and the data available from existing programs was complete enough with minor modification to satisfy model input requirements.

The data requirements for the model are detailed in Figures 4 through 7, which represent the first two blocks of the ATSSM functional flow diagram. For block 1A (Figure 4), all data are judged to be available with the possible exception of the number of airframes discarded after recovery, a data item that could be easily provided. The required delivery information could be made available from DCAS. All other data in this block are available directly from one or more of the NAVMISCEN PT 1200-series data sorts of 3M tapes.

For block 1B (Figure 5), the data requirements are largely satisfied by the information contained in NAVMISCEN's Aerial Target Performance Reporting System, reports PT 1200 and 1201. The number of presentations per flight does not appear in

these reports and it is not known how this parameter can be obtained. Lacking any better information, an estimated average number of presentations per flight for each target type might be acceptable.

Data to support the requirements of block 1C (Figure 6) are largely contained within the PT 1200 series reports based upon 3M tapes, and on the TEMPER-7 maintenance performance reporting system. An exception is the method of launch for each flight. This information could be easily included in the existing reporting system or it could be derived from knowledge of location, target type, and user. Launch-method data are required to develop reliability estimates from historical data.

Delivery schedules required for block 2 can be obtained from a review of contract files, in particular the DD-1423 forms.

Availability considerations in block 5 require some form of downtime statistics from historical data. The TEMPER-7 maintenance report is adequate for this purpose, although some effort will be needed to sort the data to extract appropriate information.

4.2 POTENTIAL UTILIZATION OF MODEL

Of the several uses of the ATSSM, perhaps the most important is that of supporting major-resource planning and allocation decisions. This would involve preparation of outputs once or twice a year on an interacting basis involving PMA-247 and the budget planners within OPNAV. Interactions would most likely result from questions involving candidate variations and their impact on the proposed budget for new buys. These questions could be readily answered on a quick turnaround basis, which would provide a new dimension of planning visibility and resolution of logistical support uncertainties.

Random requirement for impact assessments are foreseen, which could be handled on an as-required basis. Questions regarding the impact of certain changes to the budget or to the operational utilization would be formulated in terms of increments to the model data base. Model runs with the new data would quickly and clearly illustrate the downstream impact on the supportability of total operational requirements. A good example is determining the impact of incorporating a major modification to an operational target. Simulation of the support ramifications of a modification program could be developed without difficulty. The delivery schedule

could be readily adjusted to indicate negative delivery to account for removal of the airframes from the flight line, followed by positive deliveries after a given modification delay.

Utilization of the model on a regular basis would provide a management summary of status of inventory and of alert situations in the downstream projections, However, a monthly update does not seem necessary.

4.3 FOLLOW-ON EFFORT

The following efforts are suggested to implement the Aerial Target Status Summary Model:

1. Select one target and define the scope of configurational combinations.
2. Develop mission reliability arrays for that target type.
3. Develop the mission survivability array for that target type.
4. Finalize the algorithms indicated in the model description of Section 2.1.
5. Prepare flow charts suitable for coding in a language compatible with NAMISCEN equipment.
6. Prepare sample initializing-data for the data base.
7. Code and debug the model modules and initializing data.
8. Code the data base arrays.
9. Exercise the model for adequacy.
10. Prepare and debug the necessary modifications.
11. Repeat Steps 1, 2, 3, 6, 8, and 9 for other target types.